NOAA'S National Weather Service

Advanced Concepts of
Severe Storm Spotting

2011 – Rusty Kapela
Milwaukee/Sullivan
Weather.gov/milwaukee

Problems Spotters Encounter

- Spotters can only see a limited area, and much of the time the spotter view is being blocked by rain/hail, hills, trees, and buildings.
- Spotters have a hard time getting the “big picture” of what is going on around them.
- Mobile spotters may not have access to radar data to find where to go.
- Spotters have a hard time judging distances to weather phenomena…underestimate…so don’t do this…besides, we don’t need this information!

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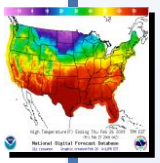
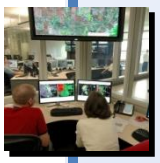
Protecting Lives and Property





Problems Spotters Encounter

- **Every storm is different – the classic text-book images, graphics, and video clips you see in this presentation will most likely not be seen all the time in the real world.**
  - *Many spotters have said "things always look different in the field."*
- **If the storms are moving rapidly you will not have much time to recognize the important features and "put it all together"**
  - *this is when you are likely to make a mistake!*

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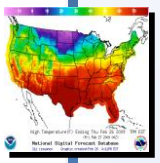

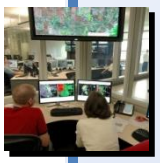

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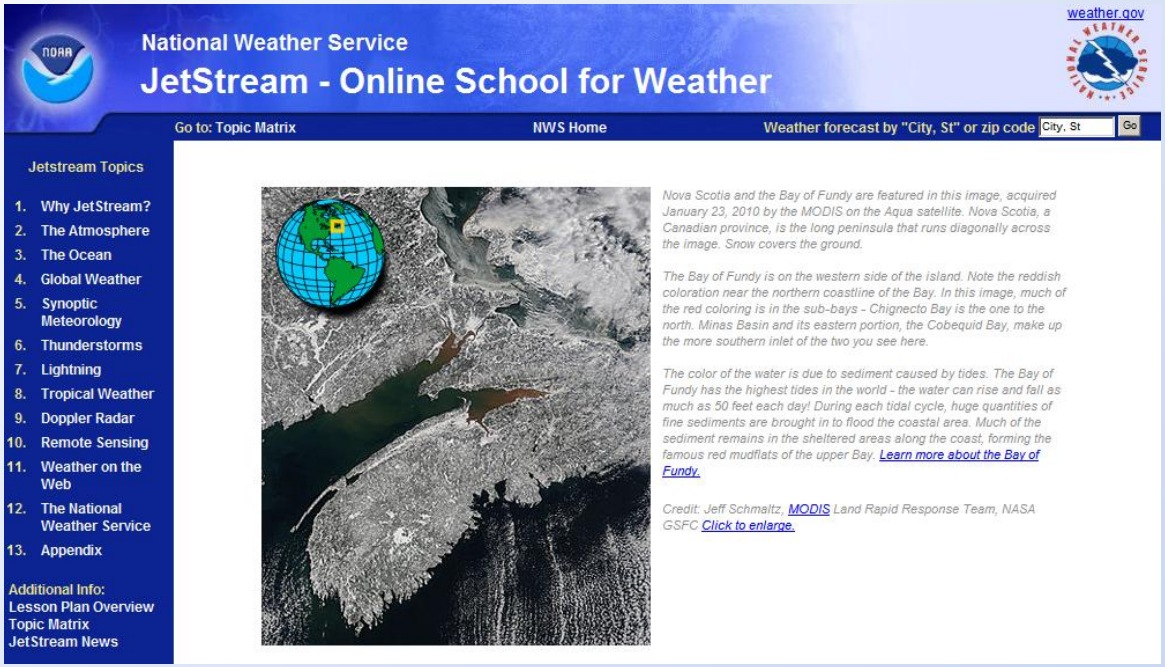
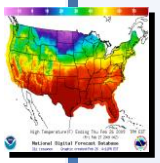
Protecting Lives and Property

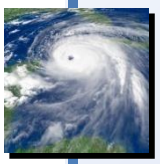
The Big Picture

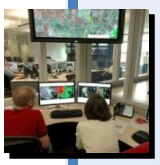
- **Spotters should self-educate themselves with on-line educational material, courses, Top News of the Day stories, SkyWarn pages, etc.**
- **The NWS Southern Region Office has an on-line School for Weather entitled "JetStream"**



http://www.srh.weather.gov/jetstream/index.htm







Thunderstorm Development

Iowa State University MesoNet

Video is time lapse fast forward

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Types of Thunderstorms

Single Cell	Multicell Cluster	Multicell Line	Supercell
Weak updraft (non-severe or severe)	**Moderate updraft (non-severe or severe)**	**Moderate updraft (non-severe or severe)**	**Intense updraft (Always severe)** **Mesocyclone - Rotating updraft**
Slight threat	***Moderate threat***	***Moderate threat***	***High threat***
			

Single Cell Storms

May produce brief severe events

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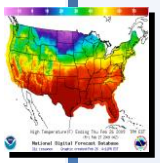

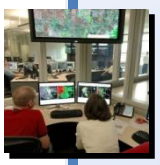

Multi-cell T'storm Clusters

Ordinary non-organized storms with low severe threat

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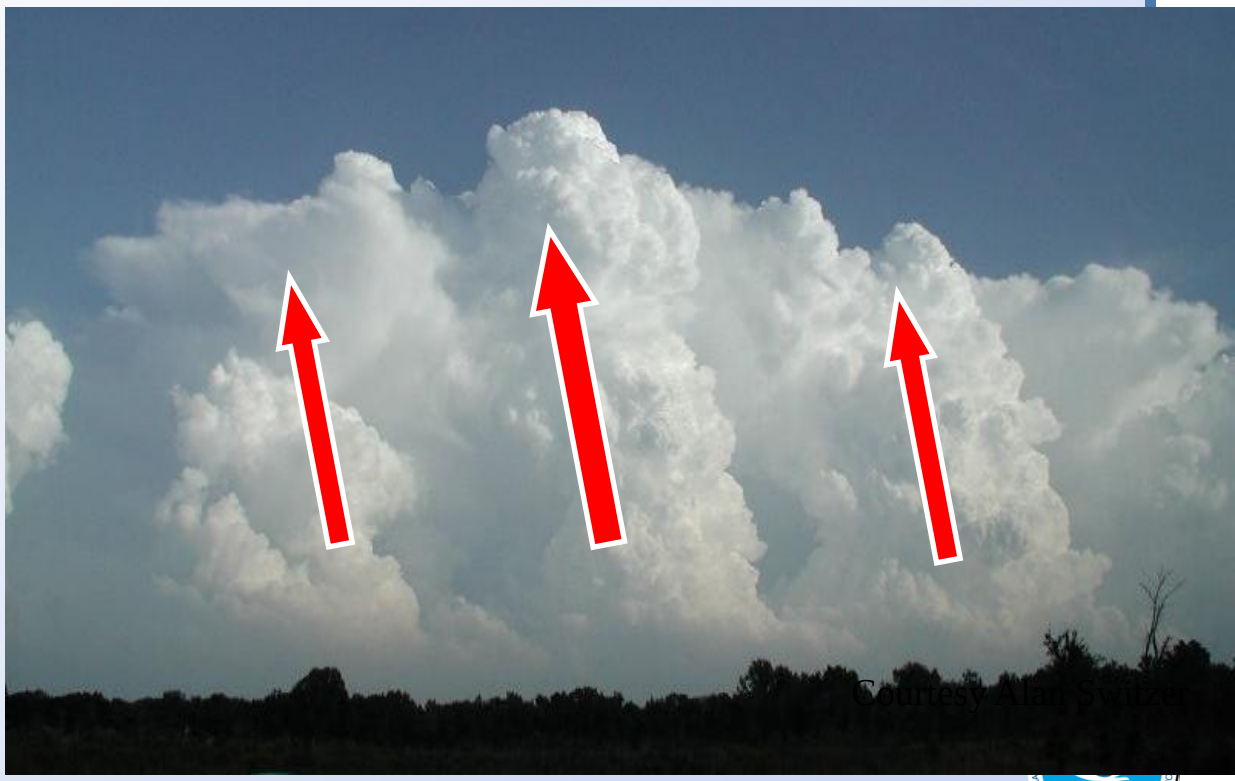
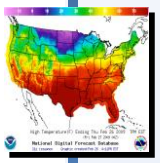
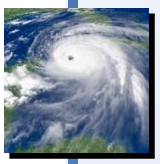
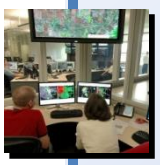
- Each cell lasts 20-30 minutes, but a cluster can last for hours



Courtesy Alan Switzer



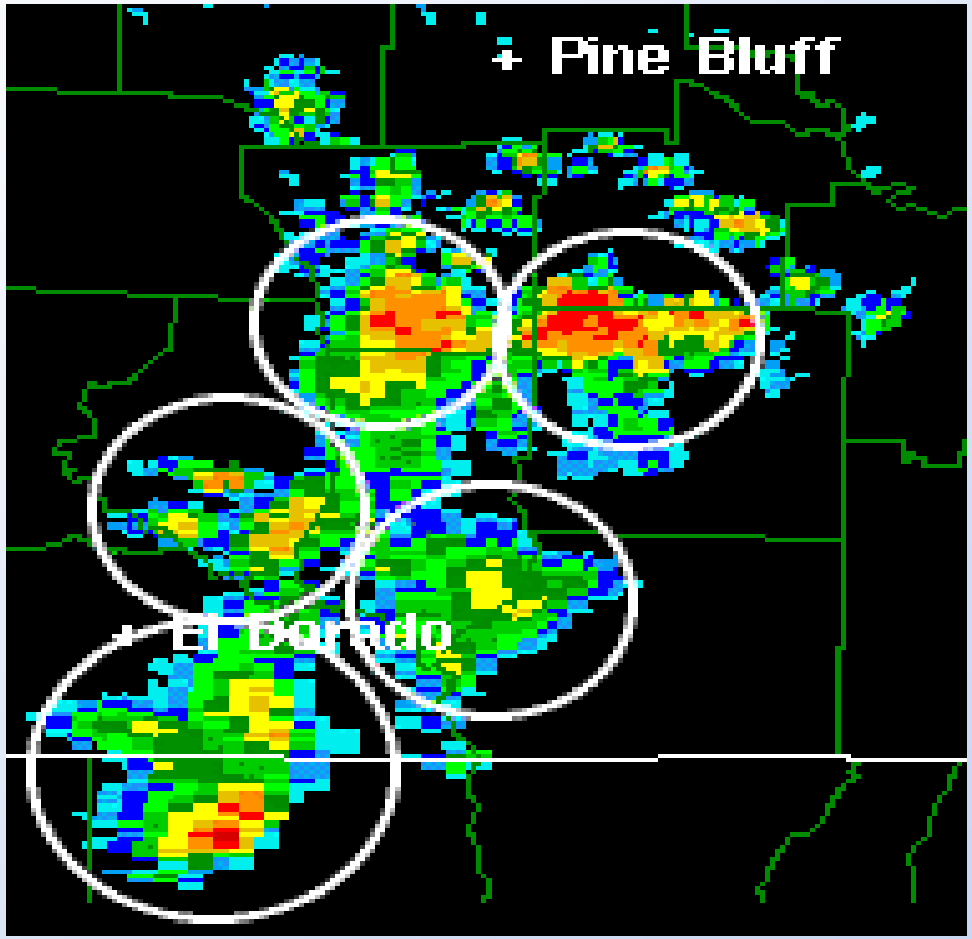




- Heavy rain is the main problem
- However, strong winds, small hail and weak tornadoes are possible

Multi-cell Thunderstorms

Ordinary non-organized storms with low severe threat



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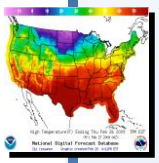
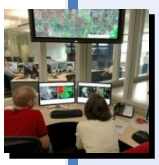
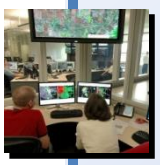




Multi-cell (Squall) Line

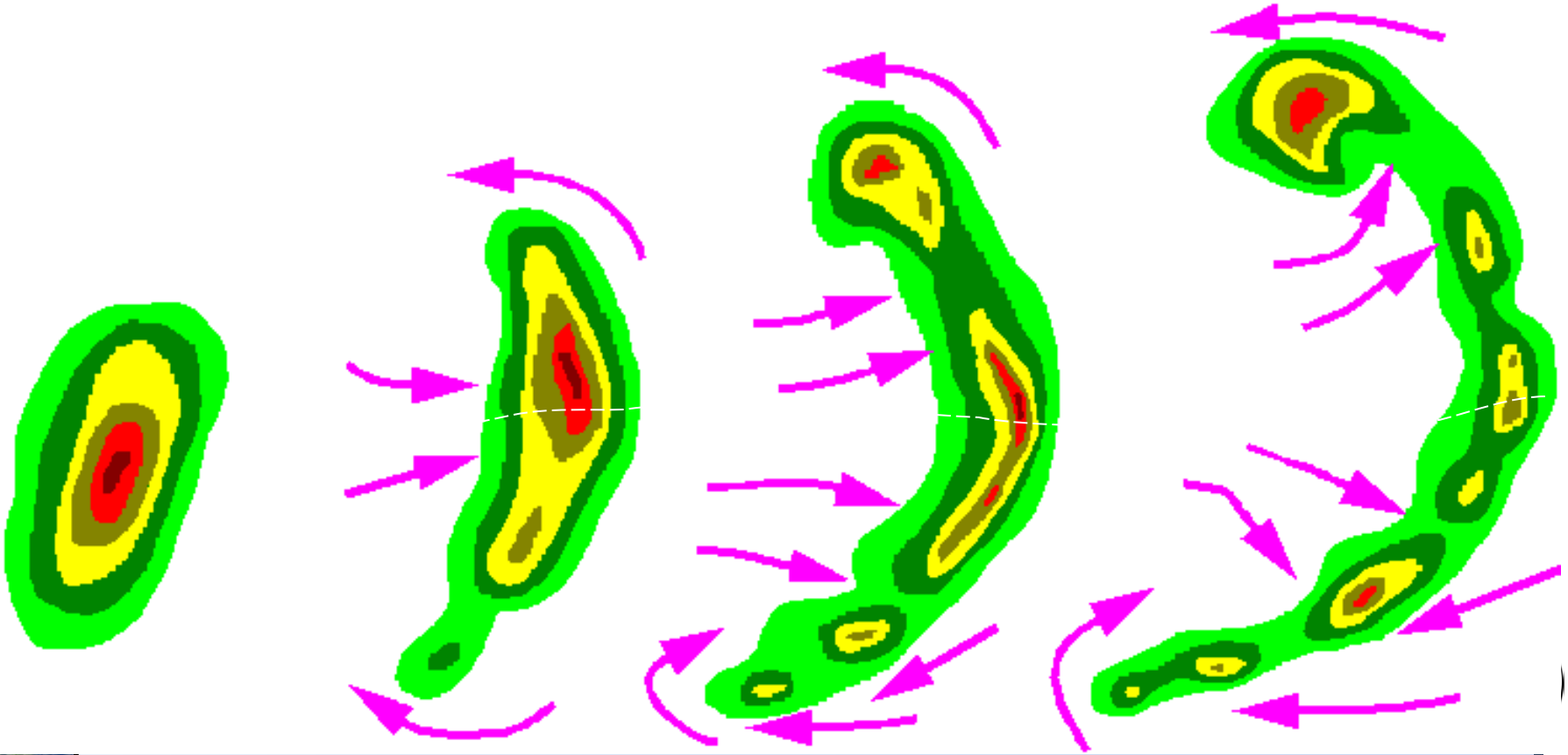


- <u>Leading edge</u> of Squall Line usually marked by shelf cloud. Do not report shelf clouds.
- <u>What to expect</u>

  Strong and possibly damaging wind

  Heavy rain/hail

Multi-cell Line (Bow Echo)



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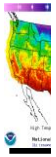
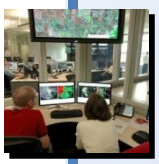
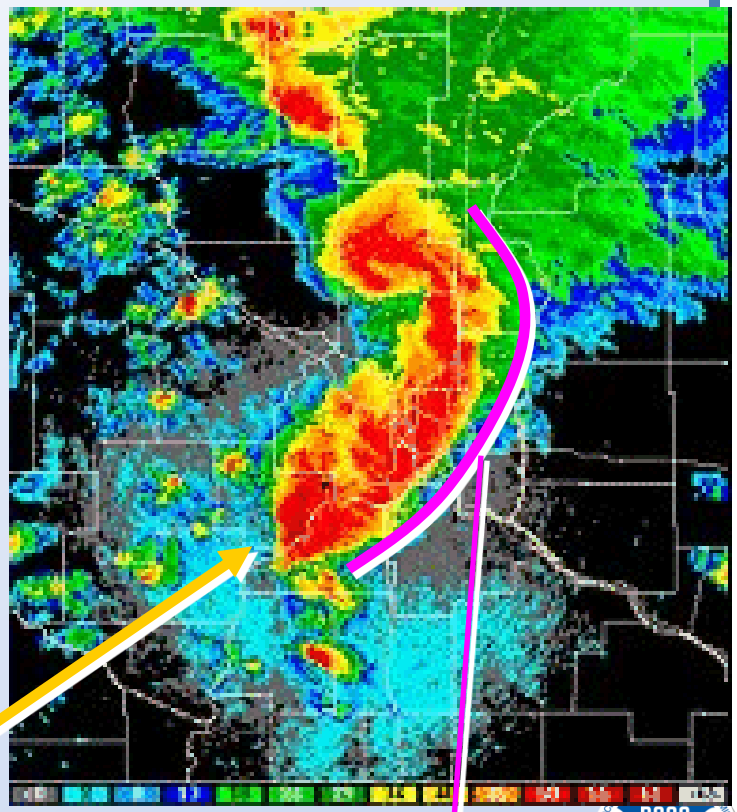




Squall Line - Bow Echo

This shelf cloud is ahead of bow echo on right!



Storm moving left to right (W-E)

Well-developed shelf cloud is found on front side of line

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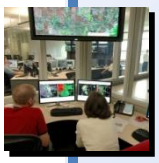
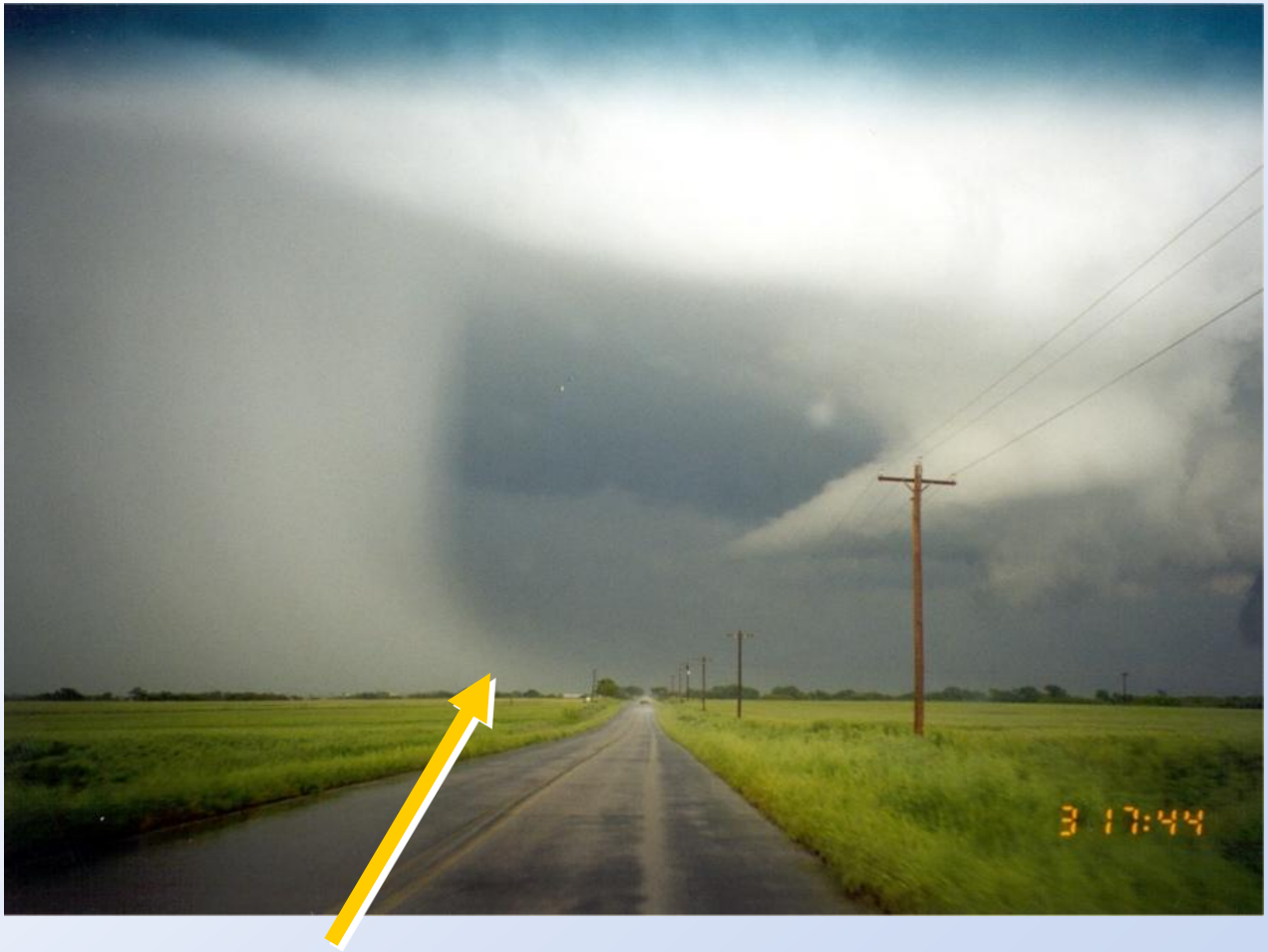


Rain Foot



Rain Foot = Strong downburst winds

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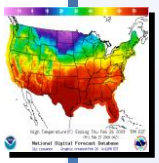

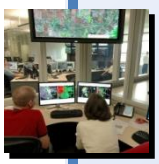

Hail Shaft

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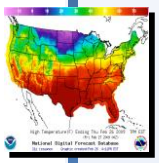
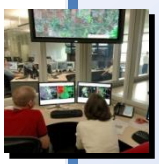
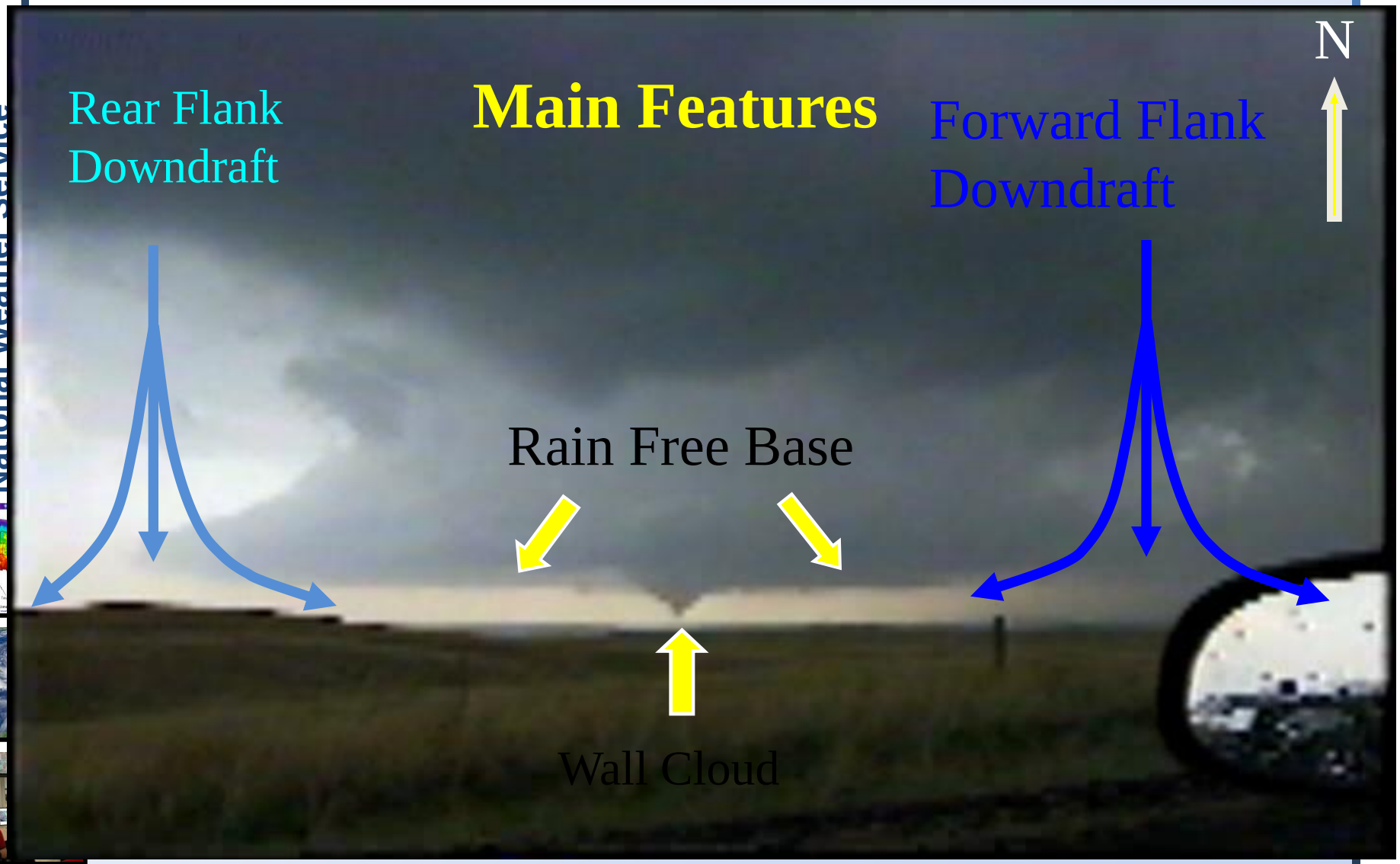




Supercell



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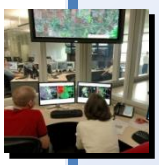
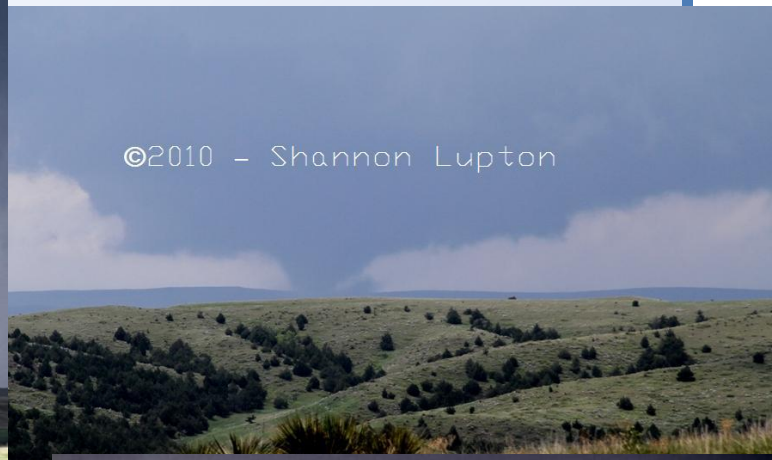
“Classic” Tornado

Near Central City, IA, Apr 26, 2009



Wedge Tornado



They look wider than the distance from the ground to the main cloud base

Rope Tornado

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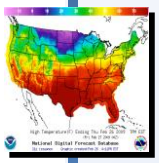
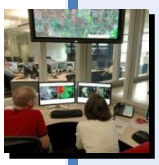
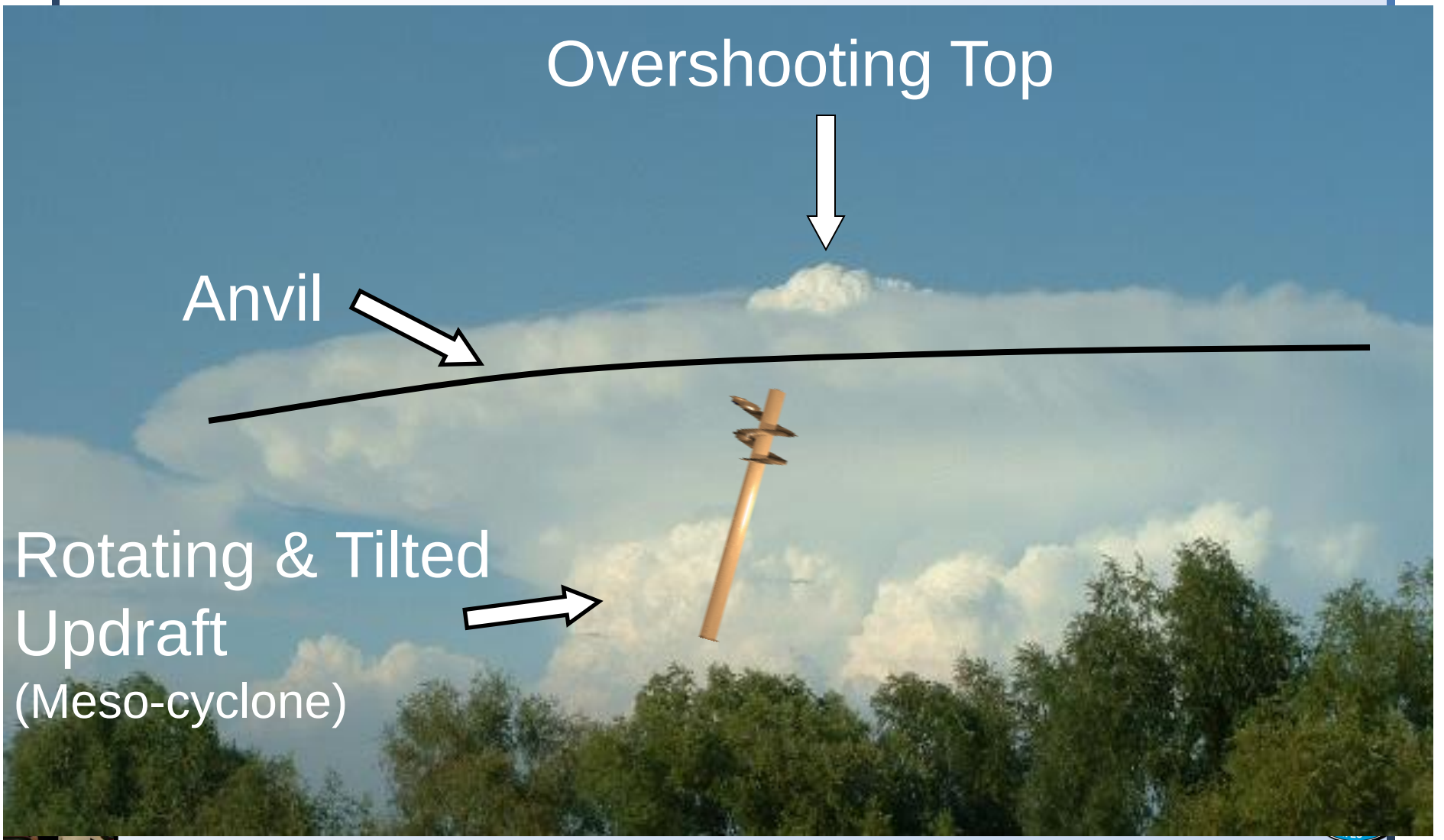




Supercell

Main Features



Supercell Thunderstorm

- Contains a rotating updraft called a meso-cyclone
- Only about 10-20% of radar-detected meso's are associated with a tornado
- Produce large hail, high winds, and strong to violent tornadoes
- Can last for several hours

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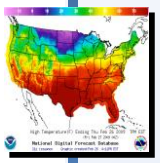
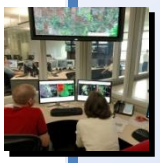
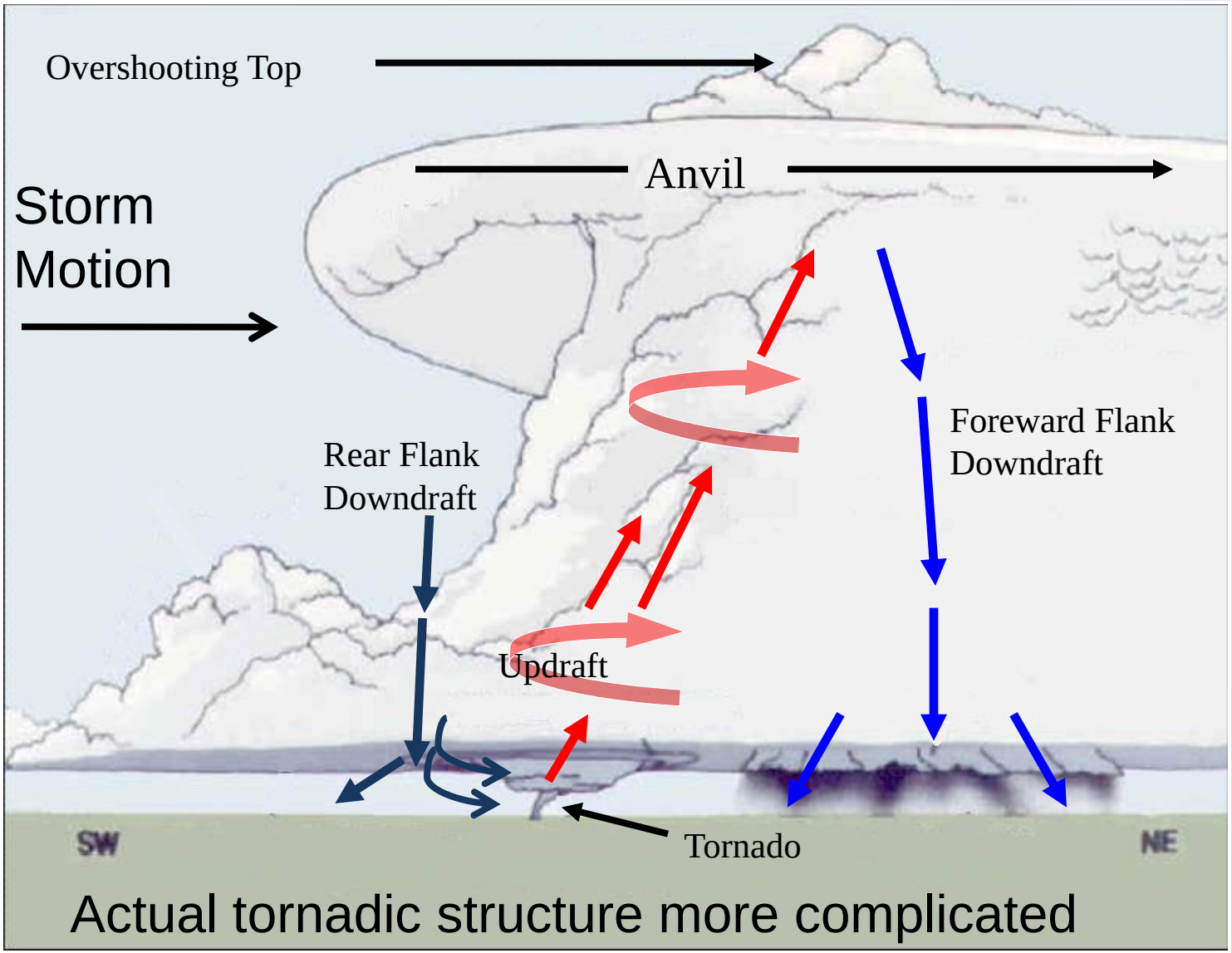




Tornadic Tstm Structure



Actual tornadic structure more complicated

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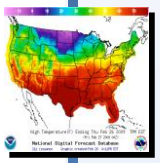
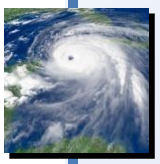
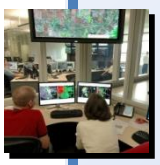
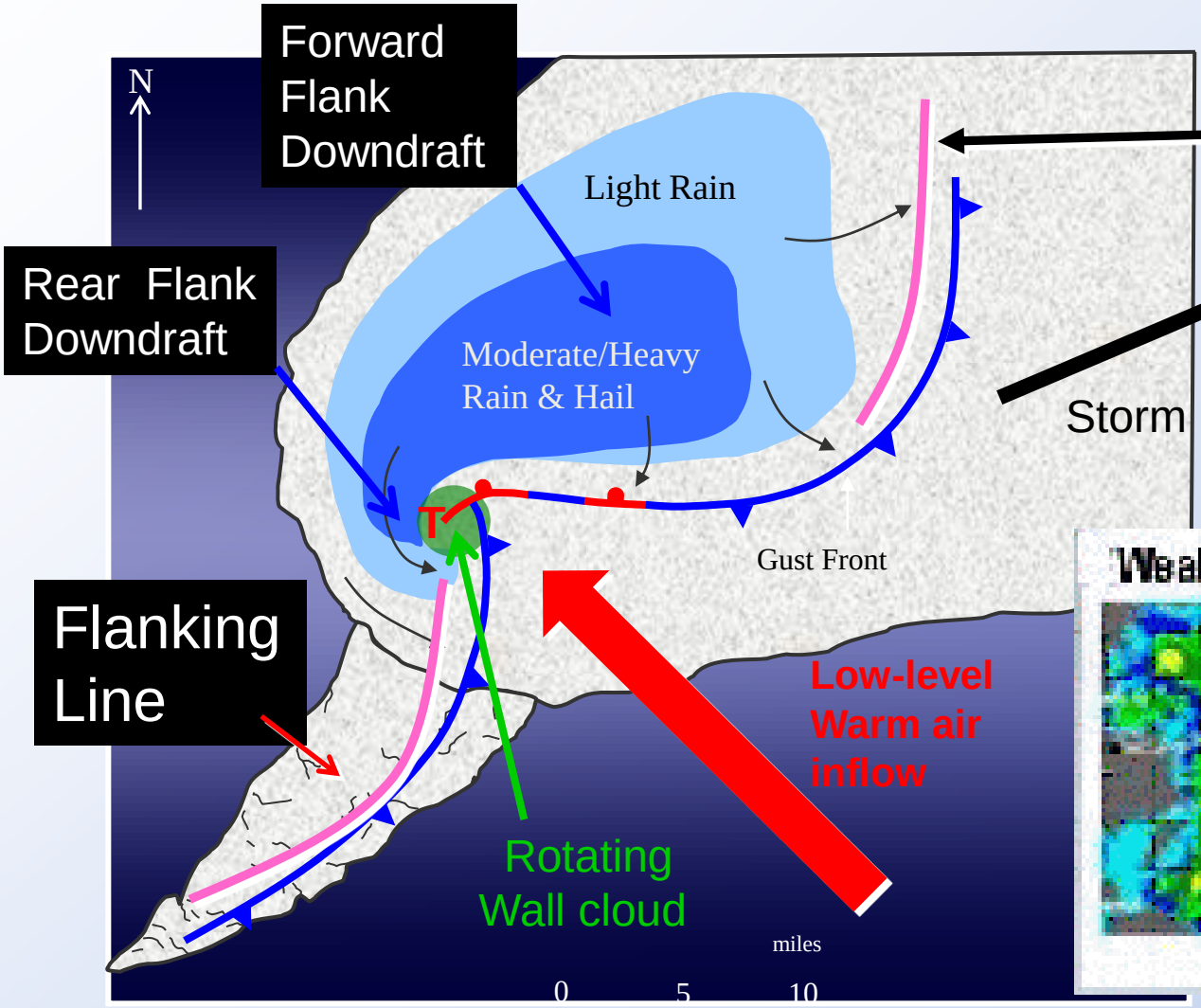
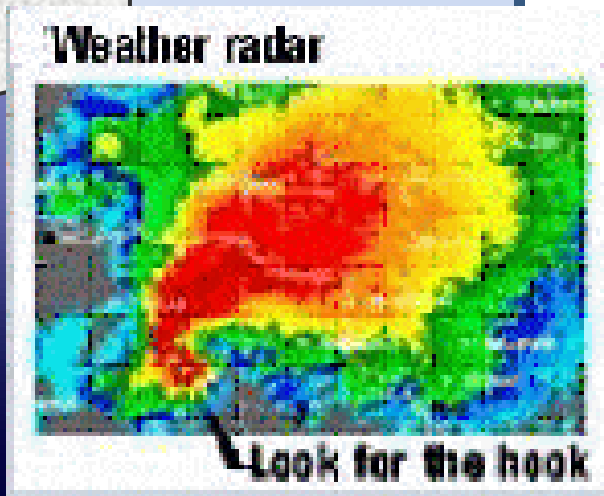






Tornadic Supercell Thunderstorm





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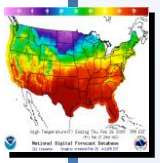
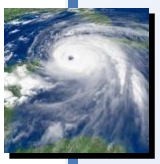
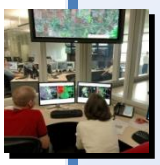
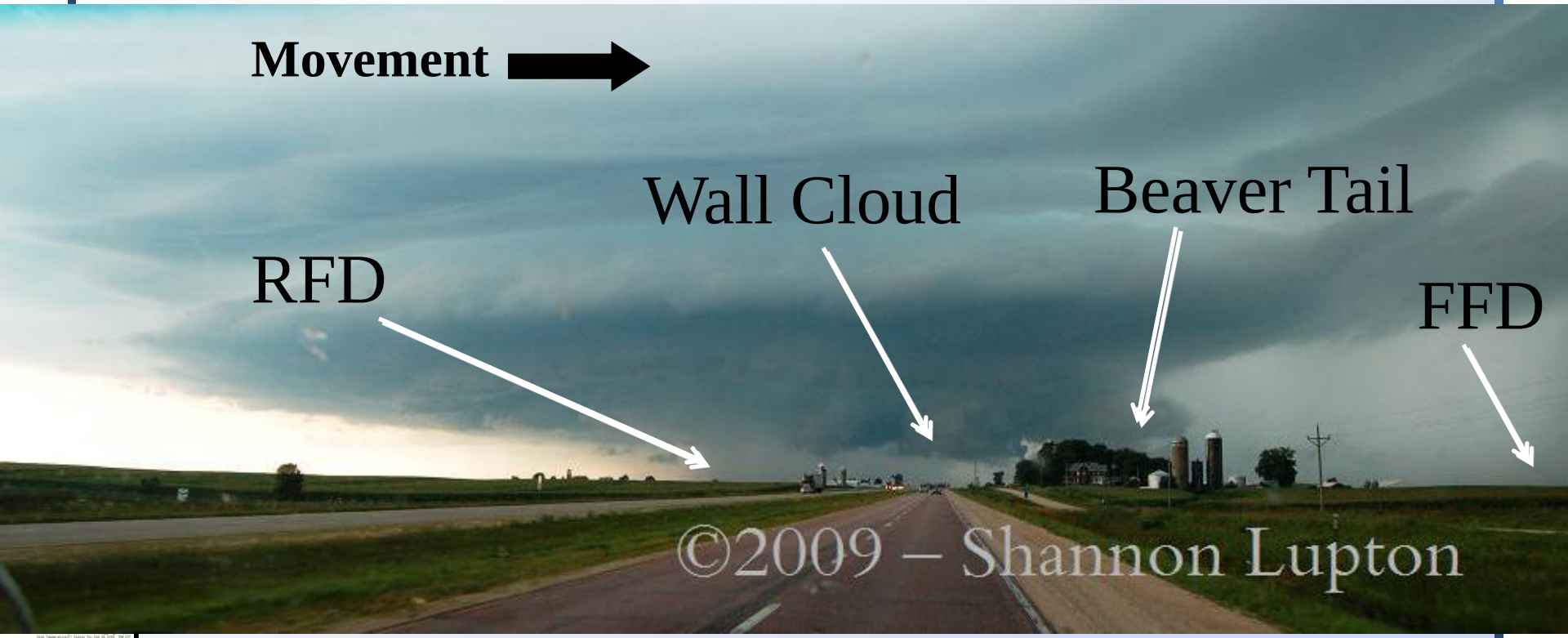
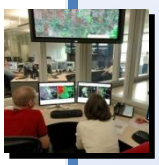




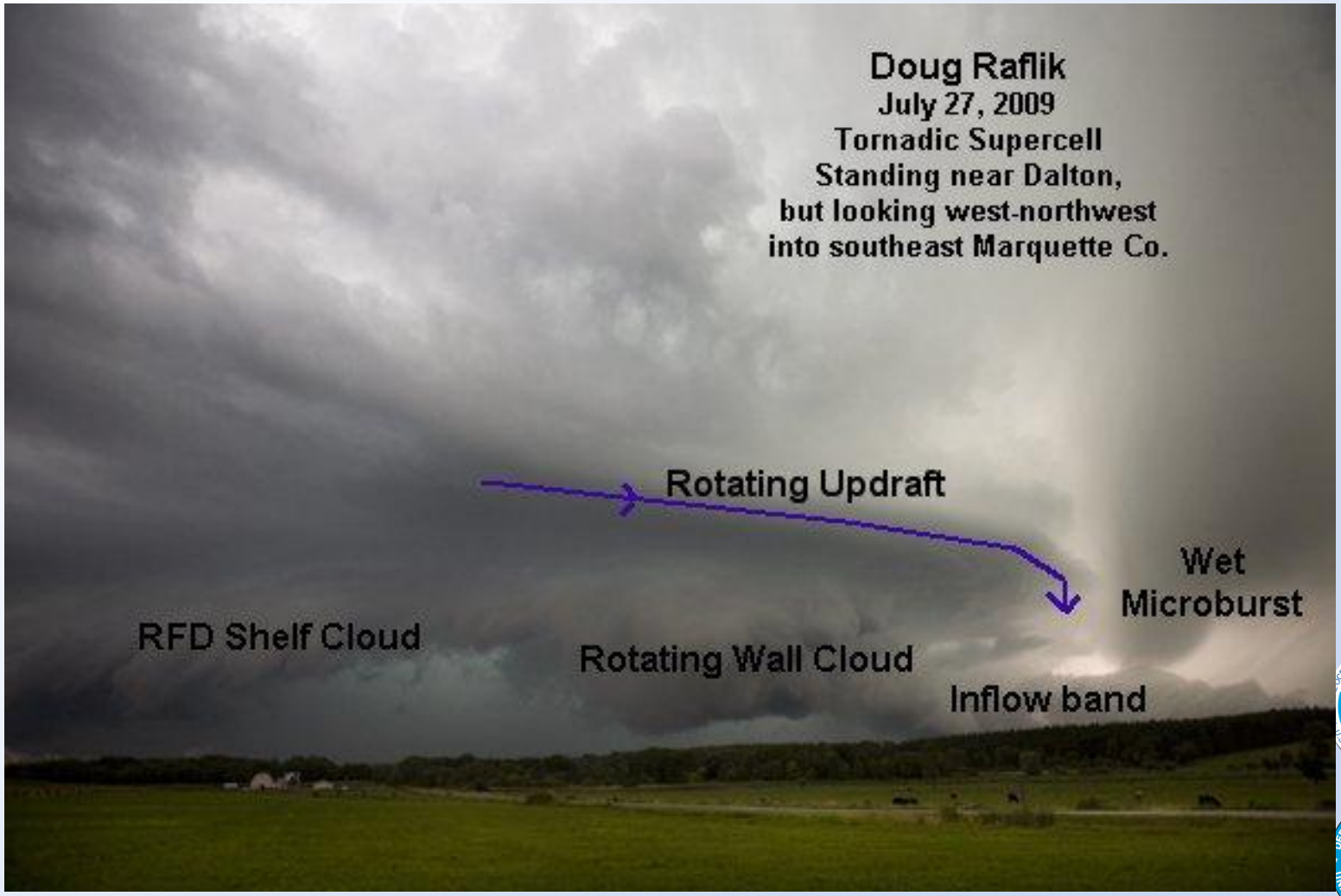


Wall Cloud


Movement
RFD
Wall Cloud
Beaver Tail
FFD
©2009 – Shannon Lupton



Supercell Features



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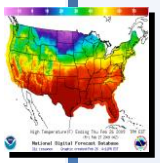
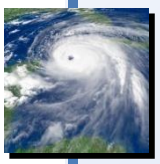
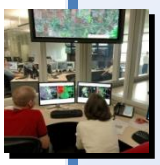
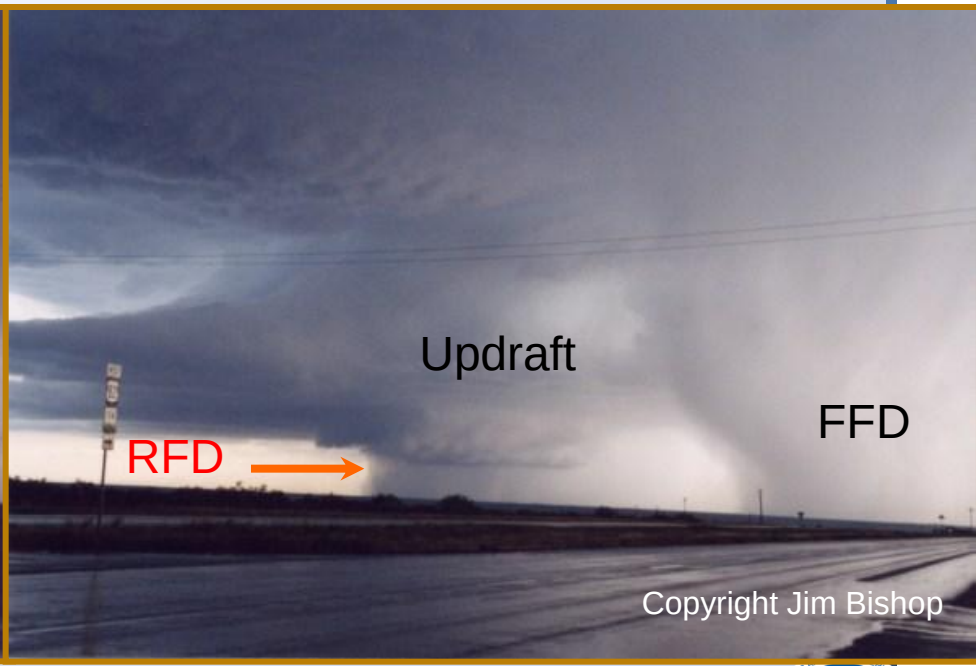
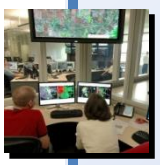






Wall Cloud & RFD & FFD

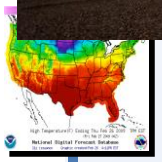


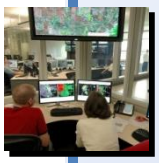


What a difference a few minutes can make!

Storm Evolution

Mike Hollingshead
July 13, 2009
Kodoka SD to Valentine NE

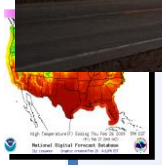


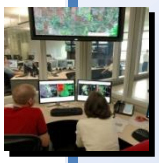


Rotating
Wall Cloud

Storm Evolution

Mike Hollingshead
July 13, 2009
Kodoka SD to Valentine NE

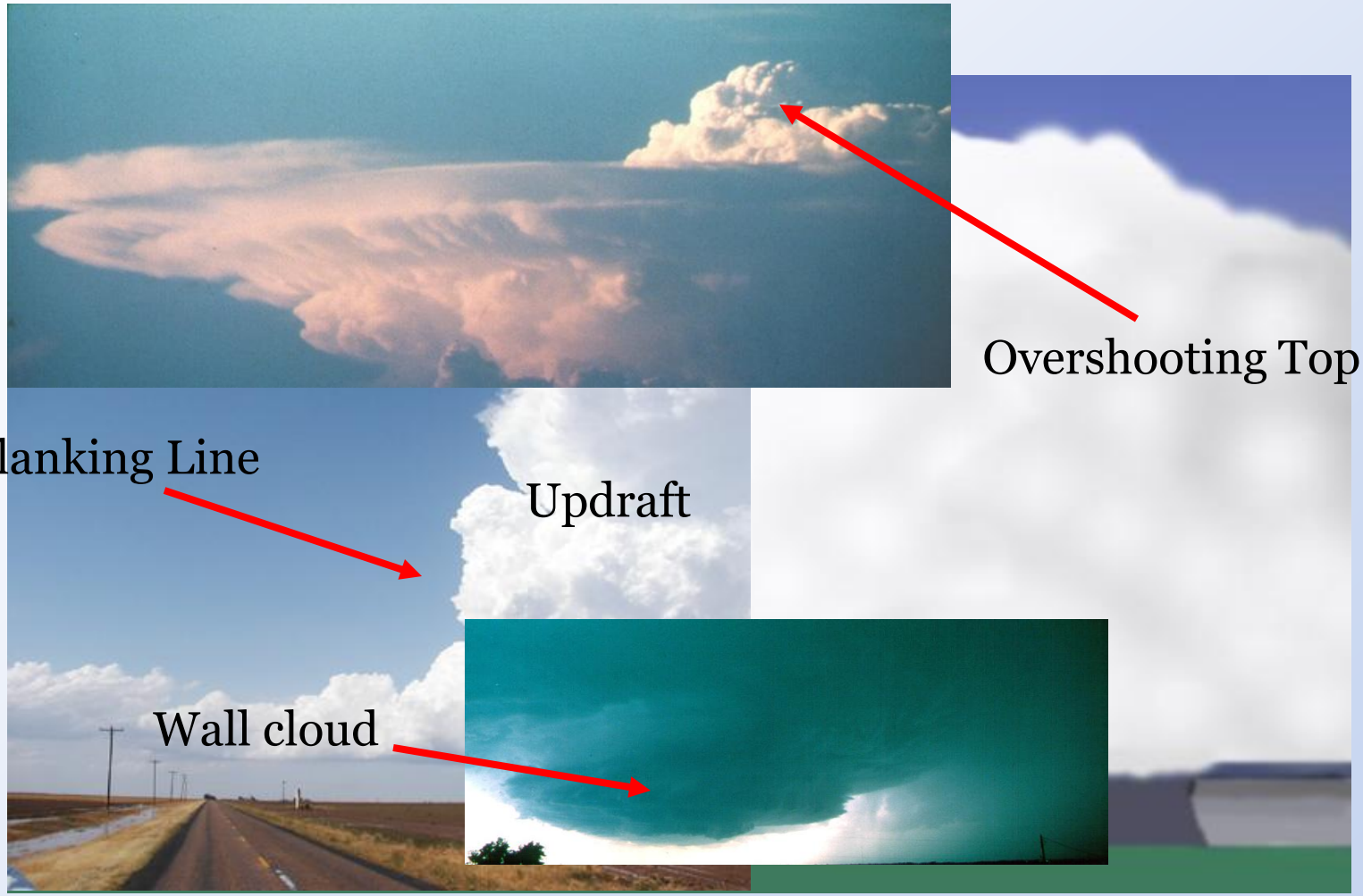




RFD

Tornado

Storm Strength Clues



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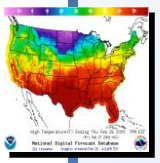
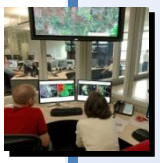
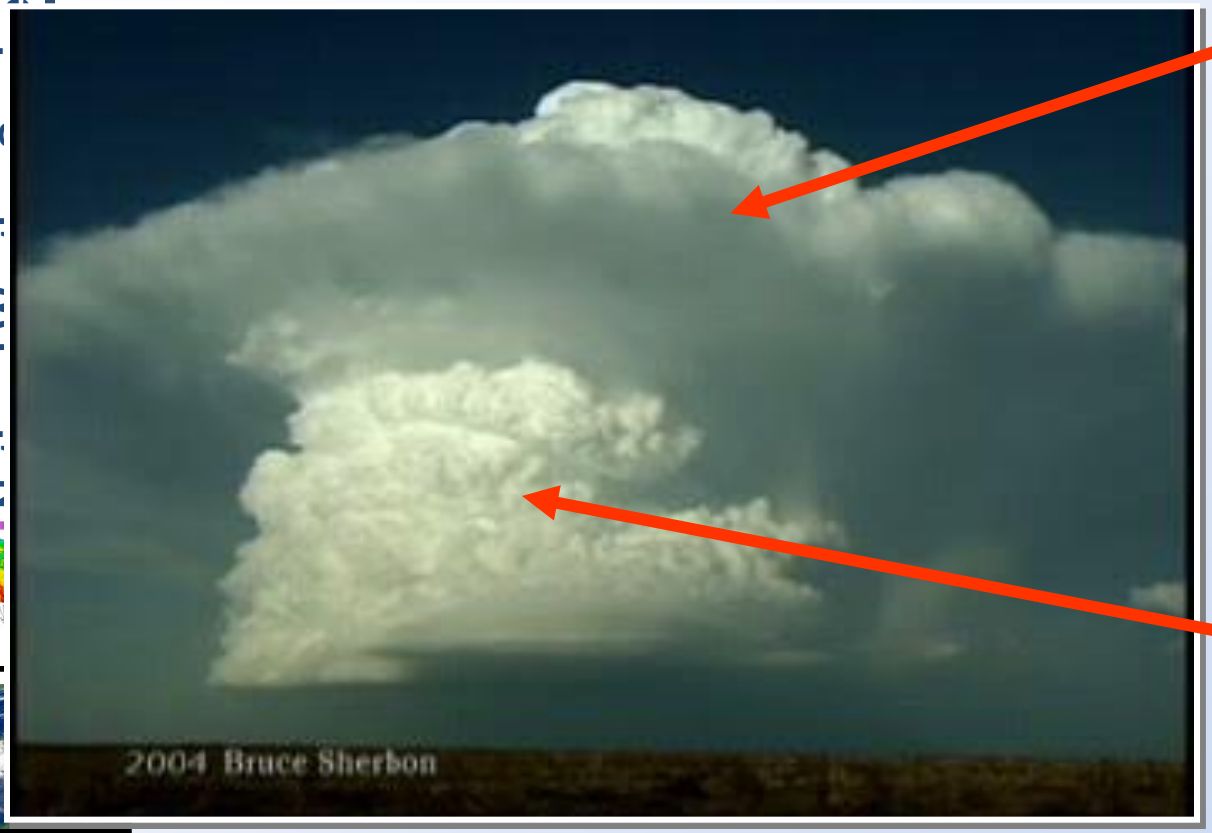




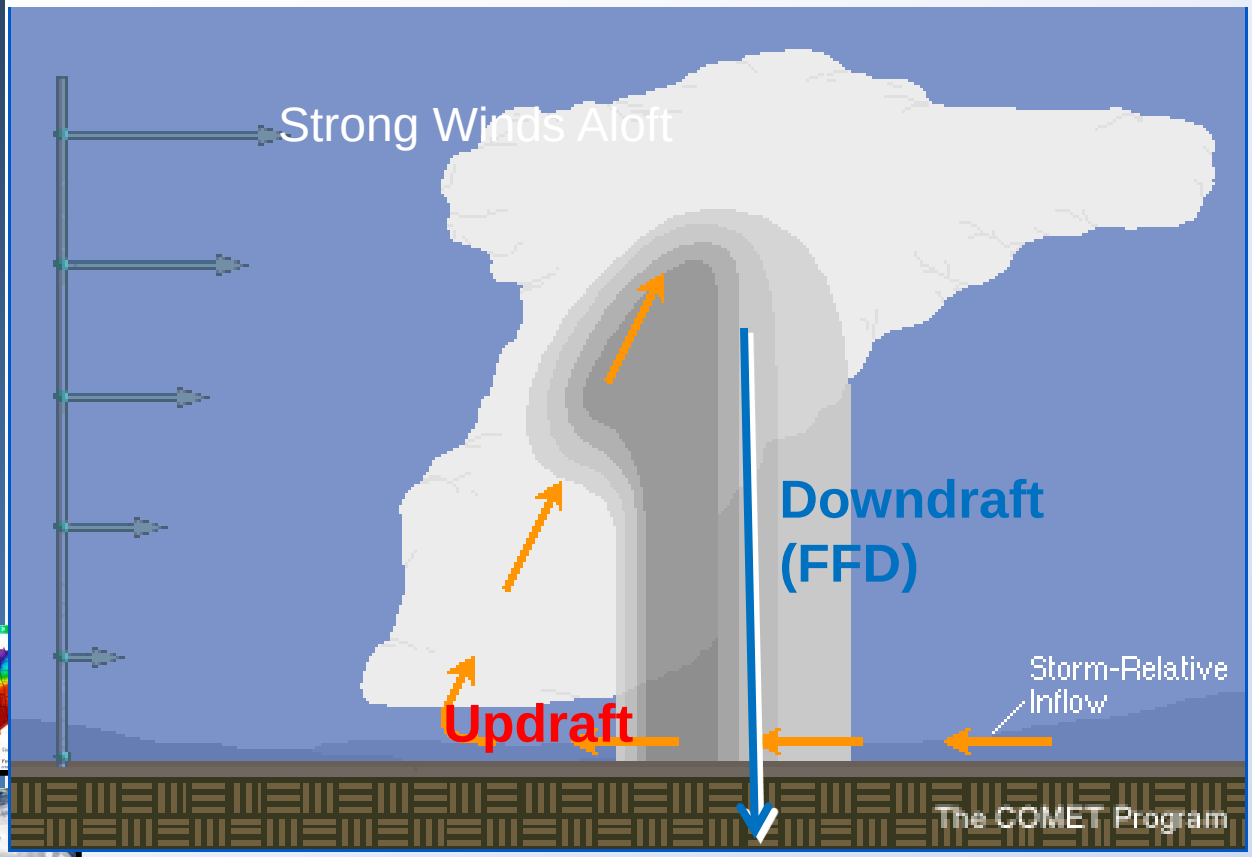
Evaluating the Surroundings



A thick, crisp anvil is another sign of a strong updraft

An indication of a rapidly, intensifying storm!

Updraft Tilt



Tilted updraft allows most of rain to fall downstream outside of updraft area.

Updraft isn't choked off by rain-cooled air and lives for more than an hour!

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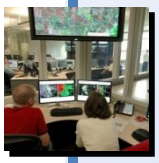
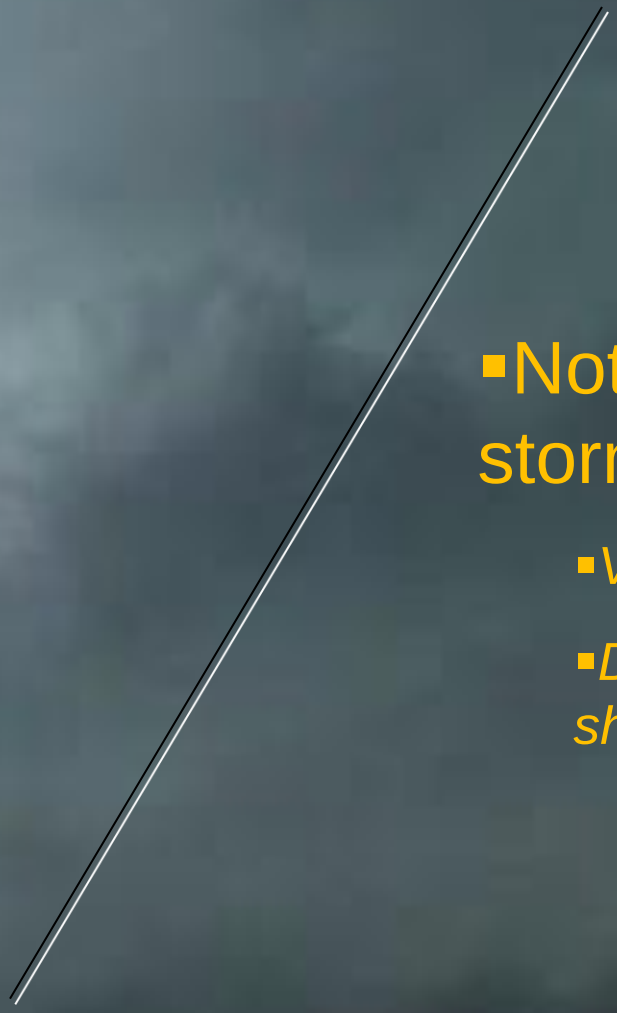


Vertical Wind Shear



- Note the tilted storm tower
  - *Vertical wind shear*
  - *Downdraft rain is shifted downstream*

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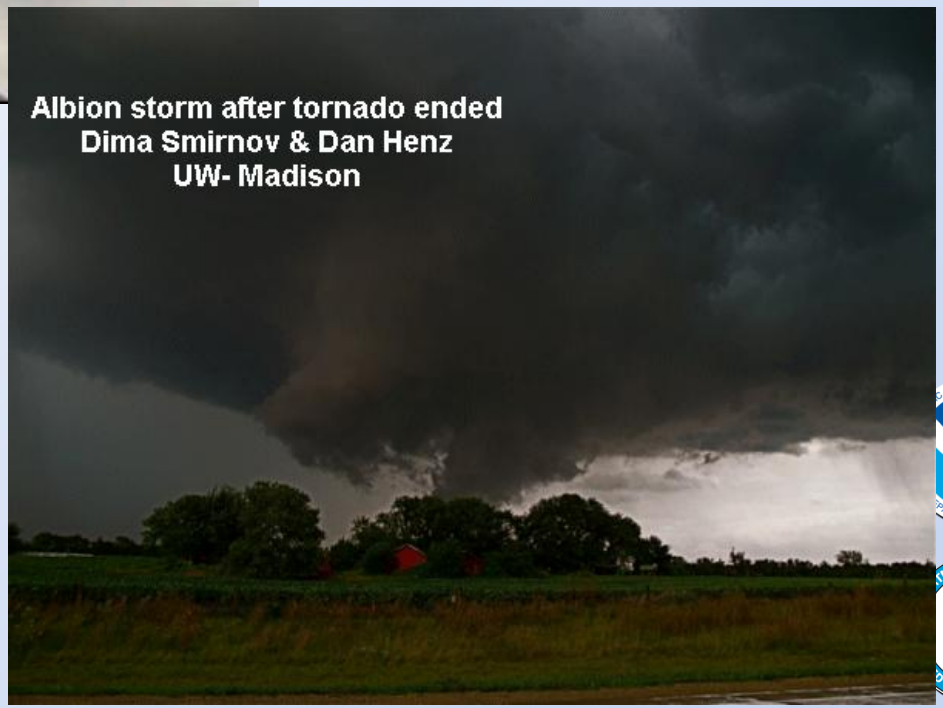

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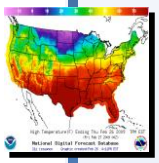

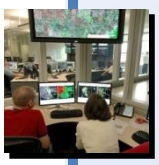

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